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NCGR-CORVALLIS REPORT

USDA/ARS

National Clonal Germplasm Repository

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February 1994

NCGR PERSONNEL

Dr. Kim Hummer, Research Leader/Curator
Dr. Barbara Reed, Cryopreservation, In Vitro
Dr. Bruce Bartlett, Greenhouse, Distr. Mgr.
Brian Courtney, Cmptr.Spec.Student
Judith Flynn, Secretary
Ray Gekosky, Ag. Res. Sci. Tech
Lisa Hunt, Screenhouse Manager
Carolyn Paynter, In Vitro Technician
Joseph Postman, Plant Pathologist
Joe Snead, Field Manager
Dennis Vandever, Facilities Mgr.
Dr. Xiaoling Yu, Research Assistant
Graduate Students

Mohan Kumar

Luo Jie

Wes Messenger

Derek Peacock

Piyarak Tanprasert

Collaborators

Dr. Henrietta Chambers

Dr. Francis J. Lawrence

Dr. Maxine Thompson

Dr. Mel Westwood

STAFFING CHANGES

Kim E. Hummer

This is a year of change for our government, agency and our own facility. Several of our staff members have found other positions and moved on. Mr. Bill Doerner, our valued Integrated Pest Management Technician, has assumed a greater responsibility. He and his family have joined The Maryknoll Lay Mission Program and have begun an assignment in Thailand. Because of budget difficulties and hiring ceilings we have not replaced his position directly. Pest management responsibility has been reassigned to staff members in charge of the greenhouse, screenhouse, and field facilities. We are greatly in debt to Bill for increasing our awareness of the cultural aspects of IPM activities, and for his enthusiasm, and esprit de corps. To Bill we say a simple "thanks" and wish him good luck in his future endeavors.

Mr. Dennis Magnello, who worked for us for about a year as greenhouse manager in charge of plant distribution, resigned last August, and is now with Northwoods Nursery, Molalla, Oregon. We have hired Dr. Bruce Bartlett to be in charge of plant requests. Bruce has been taking on the requests with gusto. We are extremely happy to have him on board.

Because of budget limitations we had to terminate the appointments for the three visiting scientists, Dr. Maxine Thompson, Dr. Henrietta Chambers, and Dr. Pat Buckley. Both Drs. Thompson and Chambers are finishing their projects as unpaid collaborators.

Dr. Buckley has recently accepted a position at Microplant Nursery, Gervais, Oregon, and will continue to work with reduction of bacterial infection of in vitro cultured plants.

With suggestions from our NCGR Technical Committee Meeting in October 1993, we have revised our staffing plan. Joe Snead has been designated as our Plant Production Manager to supervise plant movement through greenhouse, screenhouse, shade tube, and field area. Lisa Hunt is our greenhouse/screenhouse manager and Ray Gekosky (recently promoted) has accepted more responsibility in the field.

Joseph Postman, our plant pathologist, has also kept an able eye on upgrading our information management system. He is supervising Brian Courtney, our computer specialist-trainee, and Bruce Bartlett, Plant Distribution Technician. Our in vitro culture technician, Carolyn Paynter, has now rotated some responsibilities to work part-time with Joseph's virus testing program.

Xiaoling Yu, finished her Ph. D. entitled: Micropropagation and regeneration of hazelnut. She improved media formulations for the hazelnut collection and developed micropropagation systems for two non-suckering hazelnut-rootstock selections and the newly-released nut cultivar 'Willamette'. She also developed methods for regeneration of plants from leaf discs and stem segments. She was selected as an Oregon State University Research Assistant to work in Dr. Barbara Reed's laboratory and is in charge of propagation, inventory and student supervision as well as cryopreservation research. Dennis Yeo finished his Master's Degree concerning propagation of *Pyrus* rootstocks and has moved to Japan. He developed micropropagation systems for pear rootstocks. He found that auxin (either NAA or IBA) at 0.5 μ M significantly improves multiplication of the shoot cultures compared to higher or lower concentrations. Congratulations to both of these new scientists!

Drs. Ruchira Pandey and Neelam Sharma will visit in April and May. They are scientists with the National Bureau of Plant Genetic Resources in New Delhi, India, who work with in vitro and cryopreservation techniques.

Derek Peacock continues his Master's Degree concerning *Rubus* seed germination. Wes Messenger has finished his laboratory work and is writing his Master's Thesis concerning restriction site analysis of the *Ribes* genome.

ZAP THE VIROID

Joseph D. Postman



No, it's not a new video game, but an effort to eliminate Apple Scar Skin Viroid from infected pear trees. Infected Chinese pears growing in vitro have been exposed to several therapy procedures. Preliminary results look very promising. More than half the plants from two treatments have tested negative for the viroid by our colleagues in Beltsville using a molecular probe. There may be hope yet in getting those Asian pears through quarantine!

Several new graduate students have begun their studies in Dr. Barbara Reed's laboratory. Jie Luo will work on cryogenic preservation of small fruit. Piyarak Tanprasert will examine bacterial contamination of in vitro *Fragaria* cultures. Mohan Kumar will begin a Master's research project on detections of variants of tissue cultured strawberries.

During 1993 we had the grand opportunity to work for several months with two visiting scientists. Dr. Gunter Staudt, *Fragaria* taxonomist from Merzhausen, Germany, examined our strawberry collection with particular interest in the recent Chilean collection. Dr. Normah, from the University Kebangsaan Malaysia, worked with Dr. Barbara Reed on cryogenic preservation of embryonic axes of *Corylus*. Our unit has greatly benefited from both of these projects.

CORE COLLECTIONS

Kim E. Hummer

Recently, the Associate Deputy Administrator for Germplasm, Dr. Henry Shands, requested that all sites establish "core" collections for their major crops. The Corvallis Repository is responding to this request in the following manner. In October, the NCGR-Corvallis Technical Advisory Committee met in Corvallis. Subcommittees were formed to review each of the major eight genera to designate accessions as members of the "core." These designations will be reviewed by the Curator and by Small fruits and *Pyrus* Crop Advisory Committees, and by other specific crop experts.

Members of the core collections will be designated in the local database and on the Germplasm Resources Information Network (GRIN), the national system. A reason why the accession was chosen as a member of the core will also be entered. Ideally, the core collection will encompass the diversity of the genus and the cultivated forms as efficiently as possible. The core may be distributed for research projects needing a diversity of samples. The core collection will be given priority in identity verification, virus testing, in vitro culturing, on-site, and remote-in-the-system backup locations (such as at NSSL). Back-up of non-core accessions will be sought at remote non-system sites, such as arboreta, botanical gardens, private or hobbyist collections.

Thus far, members of the core collections are under review. Initial designations for the core lists for *Corylus*, *Mentha*, and *Ribes* have been prepared. Those for *Fragaria*, *Pyrus*, *Rubus*, *Vaccinium* are under discussion.

The core collection will enable each of the germplasm facilities to direct the limited fiscal and personnel resources to accomplish the mission as efficiently as possible.

TISSUE CULTURE

Barbara M. Reed and Carolyn L. Paynter

The in vitro collection will change considerably in the next few months to conform to recent decisions of the Technical Advisory Committee. Some collections will no longer be kept in vitro (*Corylus*, most *Humulus*) while others will have reduced representation (*Ribes*, *Mentha*, *Rubus*) and others may change in composition (*Fragaria*, *Pyrus*, *Vaccinium*).

Bacterial contaminants from mint cultures were characterized and most were identified to the genus level. Agrobacteria, Xanthomonads, Pseudomonads and several lesser known genera were represented. Minimal bactericidal concentrations of four antibiotics were determined for the contaminants. Phytotoxicity of the antibiotics was also evaluated and treatments were developed for many of the infected cultures.

CRYOPRESERVATION

Barbara M. Reed and Xiaoling Yu

Work is continuing on cryopreservation of *Ribes* species and cultivars. Four cryopreservation methods are being tested on several genotypes to determine the most useful technique for a range of genotypes.

Dr. M. N. Normah spent a three month sabbatical leave from Universiti Kebangsaan Malaysia at the Repository. She works with cryopreservation of recalcitrant tropical seeds and tissue culture of tropical species. During her stay we studied cryopreservation of hazelnut seeds and isolated embryonic axes. Final parts of the work are being completed at this time with the assistance of Dr. Yu. Graduate student Mr. Jie Luo will begin a M.S. project on cryopreservation.

Mr. Yongjian Chan, Assistant Professor at Changli Institute of Pomology, Hebei Academy of Agricultural and Forestry Science will be at the Repository as a visiting scientist for one year starting this summer. His work with tissue culture and cryopreservation of apple cultivars is complementary to the work we are doing with pears.

UNUSUAL PEAR RELATIVE

Sorbopyrus auricularis (Koop) Schneid
Joseph D. Postman

Sorbopyrus is an intergeneric hybrid which originated sometime before 1610, probably in Europe, and has been propagated as a clone ever since. The name *Sorbopyrus* is derived from the two parents, mountain ash (*Sorbus*) and pear (*Pyrus*). In his Manual of Cultivated Trees and Shrubs, Alfred Rehder used the name *X Sorbopyrus auricularis* (Koop) Schneid. Plants that are a cross between two different genera begin with an "X". (If this were a hybrid between two different species of the same genus the "x" would be lower case and placed between the genus name and the species name.

Sorbopyrus is not derived from a *Sorbus* with compound leaves like the *S. aucuparia* L. we often see along city streets, but is presumed to be a hybrid between *Pyrus communis* L. and the simple leaved *Sorbus aria* (L.) Crantz., or European White Beam. The tree is represented in various arboreta and botanic gardens around the world, but has not been widely

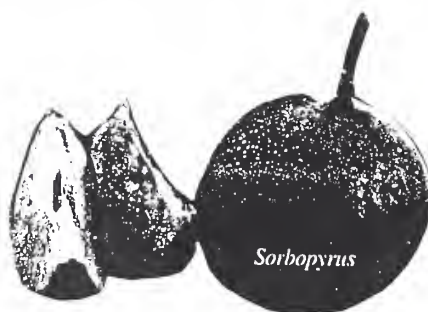
grown for its fruit. It is slow to begin bearing, and has never been extremely productive here in Corvallis, so would not make a good commercial fruit tree. The fruit, however, is quite tasty.

Like its *Sorbus* parent, *Sorbopyrus* is quite hardy. Rehder lists it as zone 5. The fruit is about the size of a plum or large apricot, slightly pear shaped, and acquires an attractive orange-red blush when exposed to the sun. It ripens in mid-August and seems to be quite resistant to scab and other diseases. In years when unsprayed Bartlett pears are completely covered with

scab, *Sorbopyrus* has a few scattered spots. It is most likely prone to fireblight. The lack of viable seeds, which appear as shriveled up seed coats, is one bit of evidence of the hybrid origin.

Sorbopyrus has picked up assorted names during its 400 years. Taxonomists have reassigned this plant to a number of different genera and species including: "*Pyrus malifolia*", "*Pyraria malifolia*", "*Sorbus bollwilleriana*" and "*Bollwilleria auricularis*". A type reputed to be more pear-like, with fruit to 4 cm across is listed by Rehder as *Sorbopyrus auricularis* var. *bulbiformis* (Tatar) Schneid. Perhaps this is the type we are growing, as we have measured a few fruits over 6 cm across. A "pear" plant arrived at NCGR from Yugoslavia with the name "Shipova" and is identical to the other *Sorbopyrus* in our collection. We grow *Sorbopyrus* on pear rootstock, and are investigating the effect on pear cultivars when it is used as an interstock.

(Ed. note: Marcia Wood published a short article on this clone in USDA-ARS Agricultural Research Magazine, December 1993. The article described the clone and its potential use as an ornamental backyard or street tree. The response was overwhelming. We have had many requests for scionwood and nurseries that sell the finished tree were sold-out this year!)



VIRAL ARRIVAL

Joseph D. Postman

Moving plant germplasm around the world is one of the fastest ways to disseminate plant viruses. About 15% of all *Rubus* plants arriving at the repository have been found to be infected with one or more virus disease. When only cultivars are considered the number jumps to 21%. We have found that raspberries are more likely to be carrying viruses than blackberries or black raspberries. The most common viruses in raspberries have been mosaic (19% of cultivars infected) and raspberry bushy dwarf (12%). Mosaic is not caused by a single virus, but by one or more of several different agents.

There is no clear "winner" with Blackberry cultivars, 15% of which arrived with one or more virus. Raspberry bushy dwarf virus, tobacco streak virus, and mosaic have each been found in about 6% of cultivars.

Viruses have been eliminated from half of our infected *Rubus* accessions through the combination of heat therapy and meristem culture. About 8% of genotypes (50 clones) are available only as virus infected plants, and with the steady arrival of new accessions, the battle goes on.

IMPORT RESTRICTION DILEMMA

Bruce Bartlett

The plant distribution policy at the NCGR-Corvallis accommodates foreign requestors as much as possible. Considerable effort goes into the processing of these requests and we want to decrease the possibility of plants dying in transit. We are therefore making small changes in the processing of foreign requests.

The government policies of many countries are becoming more restrictive in import requirements. We realize that

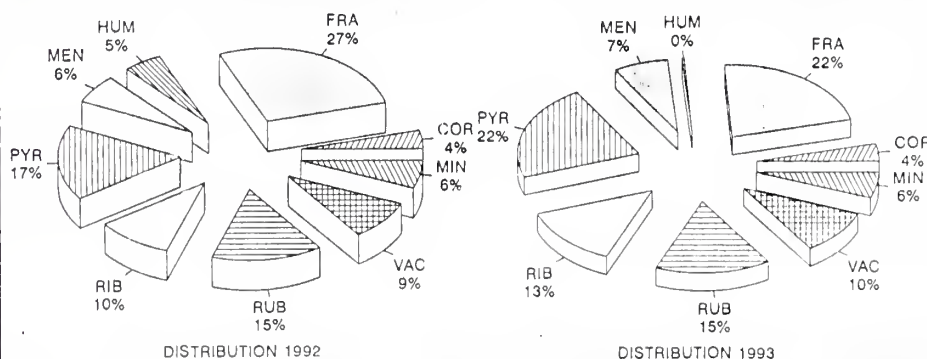
PLANT DISTRIBUTION

Bruce R. Bartlett

The NCGR in Corvallis continues to distribute plant germplasm within the United States and internationally. To date we have distributed 1,661 items for 1993 requests. This represents 70% of the total items requested (2,367). The diverse nature of plant accessions at NCGR-Corvallis presents an ongoing challenge to quickly fill requests. Items may be pending for as long as three years. The coordination of foreign import permits, seasonal availability, and slow plant growth contribute to delays in shipping. Thirteen percent of 1993 requested plants are pending and 17% are unavailable.

Foreign requestors asked for more plant items per order than did those from the United States. Foreign requestors reported a higher percentage of spoiled plants upon arrival. The cause is clearly the long time interval in transit. Domestic requestors receive plant items within three days of mailing. Packages sent airmail to foreign requestors may take up to six weeks. We continue to work with all requestors in improving our shipping methods.

Accessions of *Fragaria*, *Pyrus* and *Rubus* were the most often requested in 1992 and 1993 (see figure below). Approximately 1,000 fewer items were requested in 1993 than in 1992. The reduction in items requested was similar in all genera except for *Pyrus* which showed a much smaller drop. Request and shipment data for *Humulus* for 1993 is unavailable until late 1994.



foreign requestors are also inconvenienced by this trend and we ask for your help in making the request/shipment process as efficient as possible. For example, our plant inspector has informed us that the import requirements for the newly formed European Economic Union (EU) are more streamlined, better defined and more restrictive. Our recent experience is that these new restrictions cause our inspector to reject as much as 75% of plant material that we have prepared for shipment.

Accessions which are not virus tested or have tested positive for certain listed viruses must be rejected and cannot be sent. For pears and pear relatives, the EU asks that any plant material be certified FREE of *Erwinia*. This is impossible for scionwood collected from our orchard! Only sterile tissue cultured plants are certifiable, and not all of our pears are in culture.

In order to streamline our efforts, we will notify requestors of plant availability and status of the order as soon as possible upon receipt of the request. We also ask that foreign requestors work closely with their agricultural ministries and quarantine agencies to seek written exclusions or specific research exceptions, when appropriate. These exclusions should be stated on the import. We greatly appreciate your assistance in this matter.

PEAR CULTIVAR REGISTRY

Joseph Postman and Kim Hummer

The system for naming and registering new fruit and nut varieties has been revised by the American Society for Hort. Science and the American Pomology Society. Dr. Jim Cummins, coordinator, in Geneva, NY has assembled a group of registrars to collect information for specific crops to be published periodically in HortScience in the same format as Brooks and Olmo's Lists. We will be handling this task for pears (and some other miscellaneous pome fruits). Hugh Daubeney at Agriculture Canada, Vancouver, BC, is the small fruits registrar. Dr. Tommy Thompson in Somerville Texas will register nut crops. A dozen different crop groups have been assigned to other individuals. Persons introducing new varieties are being urged to contact the appropriate registrar to be sure that all new cultivar names are unique, and descriptions get published in a timely fashion.

MINT COLLECTION

Henrietta Chambers

In the past year, I completed a manuscript on the chromosome survey of the NCGR mint and submitted it to *Taxon*, Journal of the International Association of Plant Taxonomists. I entered most of the data from the study of herbarium collections of native *Mentha* from Australia and New Zealand into a working database. I will enter the remaining data during the next several months. This database will be provide a "packet" of information including exact localities and ecology on recent collections. We now have three of the seven native taxa of *Mentha* from Australia and New Zealand and are anxious to obtain the rest. This year we will designate a core mint collection, and repot the screenhouse plants.

SCREENHOUSE UPDATE

Lisa Hunt

This winter we are working on new legs for the *Fragaria* benches so the plants will be at a more comfortable height for all the hand maintenance they require. We are also adding benches to another screenhouse for the future expansion of the strawberry collection.

We are installing more trellis in another screenhouse for our burgeoning *Rubus* collection, and adding more benches to our newest tubehouse to increase the amount of plant material it can hold.

The *Ribes* and *Vaccinium* collections will now be maintained primarily as field plants. Certain species representatives of the *Ribes* collection will be maintained in pots until establishment in the field is certain. Only named cultivars of the *Vaccinium* collection and species that are not cold-hardy will be maintained in the screenhouse.

Extra plants removed from the screenhouses are available for pick up at NCGR through April 30. These are mature plants in 2-gallon pots and are too large to ship. There are *Vaccinium* species and breeding selections, but no extra cultivars. There are many *Ribes* cultivars as well as species and breeding selections available.

QUARANTINE PLANTS

Lisa Hunt

The Repository has been working through USDA-APHIS and Oregon State regulations to import plants from foreign countries. Currently, we have 137 accessions (a total of 286 plants) in post-entry and other quarantines. The plants are tested for viruses and other disease agents and are inspected annually by APHIS representatives. Pathogen negative plants may be released after two growing seasons. This table shows the present plants in quarantine listed by genus:

	<i>Cor</i>	<i>Fra</i>	<i>Rib</i>	<i>Rub</i>	<i>Pyr</i>	<i>Sor</i>
Accessions	31	6	90	13	18	9
Plants	82	11	111	31	39	12

RUBUS FIELD

Ray Gekosky and Kim Hummer

The old *Rubus* field collection is being removed, and a new field collection emphasizing species rather than cultivars, is being established on our north farm. In the old field, trellis wires and drip irrigation lines have been rolled and stored; poles have been yanked-out, but yet to be removed from the field. Plants are still in the ground but will be removed before the summer. Most of the field supplies will be used on our new *Rubus* seedling field. An acre of land has been worked, mounded, and seeded for turf rows. *Rubus* will be planted on mounded rows to minimize root rot problems and the planting will rotate on a regular basis. We will be assisted in much of the plant maintenance and evaluation data collection by Dr. Chad Finn, USDA-ARS Small Fruit Breeder, and his crew. Our primary *Rubus* core collection will still be maintained in screenhouses; the backup collections will be kept in tissue culture and seed storage. The core collection is being defined.

RIBES PRIMARY COLLECTION MOVES TO FIELD

Ray Gekosky and Kim Hummer

The primary collection of *Ribes* at the Repository has recently been moved out of our screenhouses and into the field at the north farm. In addition, some of the *Ribes* species not expected to grow well in the field will be

maintained in our shade house. The *Ribes* core collection will be maintained in vitro culture as a back-up and species seeds will continue to be stored.

In the past years, field plants have grown well, except for some problems such as mildew and saw fly infestations. While both of these pests make the plants look bad, they are not life-threatening and the field plants continue to grow vigorously. We will watch this field collection more carefully than in the past and will treat problems as they arise. We have pruned the plants, applied dormant oil, and are ready for spring bud break, just in time! Spring started in Corvallis about mid-February.

ACCESSION STATUS

Kim E. Hummer

During 1993 the Repository received 536 new accessions or replacement plants. The small fruits, i.e., *Fragaria*, *Ribes*, *Rubus*, and *Vaccinium*, increased the most. A number of unusual *Fragaria* species and cultivated types were donated. Scott Cameron provided replacement plants for a number of the Chilean strawberries. Several disease resistant Russian cultivars were provided by Dr. Govorava, Crimea, Russia, through the help of Dr. Galletta's laboratory. A form of white fruited *F. vesca*, (Thank you, Ray Clark), and several European and Asian species were donated by Jim Luby and Gunter Staudt.

Many *Rubus* seeds from recent collecting trips were germinated. The diversity of *Rubus* plant habit and leaf morphology continues to amaze us. We also received *Rubus chamaemorus* seed from Sweden, Finland, and Alaska.

The National Quarantine Laboratory in Beltsville, MD released 15 black currant cultivars from their testing program. Several additional *Ribes* species native to western US were collected or received.

For the *Vaccinium*, a number of lingonberries and little leaf cranberries were obtained. Jim Ballington provided a number of diploid blueberry x cranberry hybrids, seedlings from Ecuadorian blueberries, and other North Carolina selections.

We received a number of Russian *Corylus* cultivars from L. Burnistrov, and several Italian cultivars from Professor Tombesi, San Pietro, Italy. Our cooperator, Shawn Mehlenbacher, Oregon State University Hazelnut Breeder, also recently obtained several *Corylus* selections from Tbilisi. All these must remain in post-entry quarantine for a minimum of two years, and will then be available to requestors.

Recently, Phil Forsline USDA-ARS of Geneva, NY went to Kazakhstan mainly to collect apples. They also collected and sent to us, seed of *Pyrus regelii*, which may have pear rootstock potential.

After 13 years our collections have fair representation of the diversity of cultivated sorts of our assigned crops. Many of the wild relatives of these cultivars are as yet unrepresented, particularly in the small fruit species. Future collection trips will emphasize this acquisition.

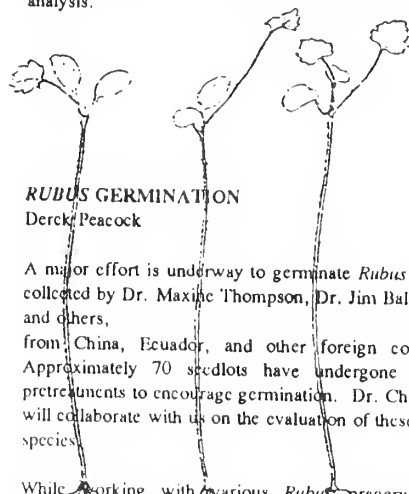
RIBES: MOLECULAR BIOLOGY

Wes Messinger

Knowledge of evolutionary relationships and genetic distances can be invaluable to the plant breeder. This knowledge is required for rigorous investigation of many basic biological questions. I have been pursuing molecular systematic research in the genus *Ribes*. My results will improve the subgeneric classification of the

genus (crosses within *Ribes* subgenera are much more likely to succeed) and provide an evolutionary framework in which to pose interesting questions about *Ribes* biology.

Infrageneric classification, i.e., sectional differences, in *Ribes* has previously relied on only a few morphological markers, such as spines, glands, or inflorescence morphology. Chemical and anatomical studies show the genus to be remarkably uniform, and do not provide useful data for systematics. I surveyed 32 species, representing all sections, for restriction site variation in two regions of chloroplast DNA. The data are remarkably consistent, and indicate that red currants, European alpine currants, golden currants, true gooseberries, and California gooseberries are each distinct and monophyletic. Unexpectedly, spiny currants and true gooseberries are united, suggesting either a sister group relationship or the possibility that one of these groups arose by an ancient hybridization event. Spines appear to have arisen repeatedly in the genus. The black currant species examined exhibit surprisingly high divergence, and are not monophyletic in the analysis.



RUBUS GERMINATION
Derck Peacock

A major effort is underway to germinate *Rubus* species collected by Dr. Maxine Thompson, Dr. Jim Ballington, and others, from China, Ecuador, and other foreign countries. Approximately 70 seedlots have undergone various pretreatments to encourage germination. Dr. Chad Finn will collaborate with us on the evaluation of these exotic species.

While working with various *Rubus* pregermination treatments, we have observed mixed responses to sodium hypochlorite (NaOCl) as a seed scarifying agent. For *R. parviflorus* Nutt., scarification with NaOCl resulted in 34% germination. Fewer than 1% of the seedlings showed any negative effects after exposure to 2.6% NaOCl for 24 hours. But in *R. urkinus* Cham. & Schltdl., *R. multibracteatus* A. Leveillé & Vaniot, *R. swinhoei* Hance, and *R. setchuenensis* Bureau & Franchet, the percentage of injury observed ranged from 40% to 100%. In these cases, although embryonic tissue did not appear necrotic, the radicle and plumule failed to elongate after emergence. The epicotyl or primary leaves did not develop, and the radicle failed to form root hair. The cotyledons, apparently unaffected, opened and were a healthy green. NaOCl did not seem to kill the embryo, but deterred development of the embryonic axis.

Future research towards the development of a new germination protocol for *Rubus* includes additional evaluation of the effects of sodium hypochlorite, as well as other germination pretreatments including sulfuric acid, potassium nitrate, and various macerating enzymes.

CURATOR'S CORNER

Kim Hummer

Great things happened this year at Corvallis! While the primary effort is service to maintain the USDA-ARS working collections of 30 genera of temperate small fruit, nuts and several agronomic crops, a number of research gems were uncovered by Repository sponsored scientists.

- Dr. Barbara Reed, working with Dr. Norma of Malaysia, determined a procedure to successfully store excised embryonic axes of *Corylus* cryogenically. This is a significant finding since up to now *Corylus* seed could not be stored for longer than one year under any conditions without losing viability.
- Joseph Postman, working with Dr. Ahmed Hadidi of the National Plant Quarantine Services Laboratory, determined a procedure to eliminate apple scar skin viroid from pears. This disease was observed in pears, obtained from China in 1984, which are now in National Quarantine. Elimination of this viroid would permit the Chinese pears to be released from quarantine.
- Derck Peacock, graduate student working with Dr. Kim Hummer, determined that sodium hypochlorite, can be detrimental to seed germination of certain *Rubus* species.
- Wes Messinger, graduate student working with Drs. Aaron Liston and Kim Hummer examining molecular biology of *Ribes* determined that black currant species are very divergent, and unexpectedly, spiny currants and true gooseberries may be sister groups. Not only that, spines have originated in the genus several times over the course of evolutionary history.
- Dr. Maxine Thompson has compiled a listing of published chromosome counts for *Rubus*. She has also determined first-reported counts for more than a dozen Asian and South American species.
- Dr. Henrietta Chambers has completed a chromosome survey for the *Mentha* collection. This paper is in revision for Taxon.
- Dr. Kim Hummer observed more than an 80-fold difference in seed size within the genus *Rubus*. This is another example of the extreme diversity of blackberries and raspberries.



WORKER PROTECTION STANDARD

Joe Sneed and Kim Hummer

In 1992, federal legislation was enacted to ensure a safer worker protection standard (WPS) for pesticide application in agricultural situations. This law is designed to protect agricultural workers and pesticide handlers. It requires that pesticides be labeled with more specific conditions for use, including personal protective equipment (PPE) needed during application and re-entry times. Material safety data sheets (MSDS) must be kept on site for every chemical used.

This regulation is affecting the repository operation in several ways. In 1993, the repository stored and used 40 pesticides. We will reduce this inventory to fewer than 20 in 1994. We will train our staff and any on-site cooperators about the WPS and about each of the pesticides. We will ensure that our emergency wash down stations at the main building are in working condition and will prepare a portable wash down station to be taken to remote fields. We have recently purchased VHF radios for the field crew. Our system includes a base station, located in the main office, and two hand held units. The radios have instant access to emergency channels and are available for general communication.

We will post spray information for our greenhouses, screenhouses, and fields in an accessible glass bulletin board outside of our headhouse. We will maintain computer inventories of applied and stored pesticides.

"Do not enter" signs will be posted prior to spraying and will be removed at the label dictated re-entry time. Staff members or cooperators wishing to enter a posted area MUST wear the required PPE, or wait until the re-entry time when the sign is removed.

Many biological control agents are not categorized as pesticides. We will continue to emphasize the cultural and biological techniques over chemical techniques for pest management, whenever possible.

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